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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/900,662	07/06/2001	Janice H. Nickel	10003488-1	6593

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HEWLETT-PACKARD COMPANY  
Intellectual Property Administration  
P.O. Box 272400  
Fort Collins, CO 80527-2400

EXAMINER

HUBER, PAUL W

ART UNIT PAPER NUMBER

2653

DATE MAILED: 02/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 09/900,662	<b>Applicant(s)</b> NICKEL	
	<b>Examiner</b> Paul Huber	<b>Art Unit</b> 2653	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 29 June 2004.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>10192004</u> . | 6) <input type="checkbox"/> Other: _____  |

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 7, 8, 11, 12, 15, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al. (USP-6,498,349) considered with Danz et al. (USP-5,637,370).

Thomas et al discloses a digital direct write electron beam matrix lithograph system (see figure 4), including an emitter array 430 which is a two dimensional array of electron beam sources, wherein the "electron emitting materials can be based on carbon nanotubes (CNT)." (see col. 6, lines 9-11). Thomas et al discloses the invention as claimed, but fails to specifically teach that the digital direct write electron beam matrix lithograph system can be used for data storage. However, Danz et al teaches that "methods are known of inscribing information at extremely high information density into thin metal or semiconductor layers with a focused and accelerated electron beam[, and] by making use of the apparatus systems developed for electron beam lithography, it is possible to produce nanometer structures with line widths smaller than 10 nm" (col. 1, lines 8-13), in the same field of endeavor, for the purpose using lithography systems for high density storage of information.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Thomas et al such that the digital direct write electron beam matrix lithograph system of figure 4, which includes carbon nanotubes (CNT) as the emitter array 430, is used for data storage as taught by Danz et al. A practitioner in the art would have been motivated to do this for the purpose of using the lithography system of Thomas et al for high density storage of information.

Regarding claims 7 and 15, Thomas et al discloses a bias grid 440 which comprises the claimed word and bit lines for addressing each emitter of the EA 430 (nanotubes) as claimed.

Regarding claims 8 and 16, Thomas et al discloses in reference to figure 4 a micromover 470 for focus positioning of the array on the medium 420.

Claims 4 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al and Danz et al, as applied to the claims above, in further view of Gibson et al (USP-5,557,596).

Thomas et al as modified and applied to the claims above disclose the invention as claimed, but fails to specifically teach that the storage medium includes a phase-change storage layer. Gibson et al discloses a data

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storage device comprising an array of electron sources for storing and reproducing information from a phase-change material (see figure 4B), in the same field of endeavor, for the purpose of reversibly storing and reproducing information on a recording medium at extremely high density.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify Thomas et al such that the storage medium includes a phase-change storage layer proximate the tips of the nanotubes as claimed and as taught by Gibson et al. A practitioner in the art would have been motivated to do this for the purpose of reversibly storing and reproducing information on a recording medium at extremely high density.

Claims 5, 6, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al and Danz et al, as respectfully applied to claims 1 and 11 above, in further view of Official Notice.

Thomas et al as modified and applied to the claims above discloses the invention as claimed, but fails to specifically teach that the nanotubes are elongated and have an aspect ratio of at least 10:1. However, it is manifestly well known in the art of nanotube technology that nanotubes are preferably elongated and made to have a higher aspect ratio such as at least 10:1 in order to provide better directionality, and Official Notice is hereby given.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify Thomas et al such that the nanotubes are made to be elongated and have an aspect ratio of at least 10:1 as well known in the art. A practitioner in the art would have been motivated to do this for the purpose of providing better directionality to the nanotubes thereby improving emitter performance and accuracy.

Relative to the doctrine of Official Notice, see *In re Fox*, 176 U.S.P.Q. 340 at 341 (CCPA 1973).

Claims 3 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al and Danz et al, as respectfully applied to claims 1 and 11 above, in further view of Choi et al (USP-6,472,802).

Thomas et al as modified and applied to the claims above discloses the invention as claimed, but fails to specifically teach that the nanotubes are boron nitride nanotubes. However, it is manifestly well known in the art that nanotubes can be made up of boron nitride instead of carbon (see for example, Choi et al, col. 3, lines 48-49), in the same field of endeavor, for the purpose of using an alternative material which is suitable for nanotube technology which may meet the manufacturer's demand and expense.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify Thomas et al such that the nanotubes are boron nitride nanotubes instead of carbon based, as well

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known in the art and as taught by Choi et al. A practitioner in the art would have been motivated to do this for the purpose of using an alternative material which is suitable for nanotube technology which may meet the manufacturer's demand and expense.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al, Danz et al, and Gibson et al, as respectfully applied to claim 9 above, in further view of Choi et al (USP-6,472,802).

Thomas et al as modified and applied to claim 9 above discloses the invention as claimed, but fails to specifically teach that the nanotubes are boron nitride nanotubes. However, it is manifestly well known in the art that nanotubes can be made up of boron nitride instead of carbon (see for example, Choi et al, col. 3, lines 48-49), in the same field of endeavor, for the purpose of using an alternative material which is suitable for nanotube technology which may meet the manufacturer's demand and expense.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify Thomas et al such that the nanotubes are boron nitride nanotubes instead of carbon based, as well known in the art and as taught by Choi et al. A practitioner in the art would have been motivated to do this for the purpose of using an alternative material which is suitable for nanotube technology which may meet the manufacturer's demand and expense.

Applicant's arguments filed June 29, 2004 have been fully considered but they are not persuasive. The applicant argues that the "examiner states his opinion that it would be obvious to use Thomas et al.'s emitter array in place of Danz et al.'s electron scanning microscope," and as such the prior art does not suggest the desirability of such a combination. The examiner respectfully disagrees in that the examiner never stated that it would have been obvious to use Thomas et al.'s emitter array in place of Danz et al.'s electron scanning microscope. Rather, it was the position of the examiner that it would be obvious to use Thomas et al.'s array of electron beam sources (carbon based nanotubes) for data storage, based on Danz et al.'s disclosure that it is well known in the art that electron beam lithography systems can be adapted for high information density storage of information. Danz et al. recites that since "it is possible to produce nanometer structures with line widths smaller than 10 nm" (col. 1, lines 8-13) with electron beam lithography systems, it is advantageous to adapt such systems to be used to inscribe information at extremely high information density into a storage medium for data storage. Therefore, one of ordinary skill in the art would recognize from Danz et al. that the CNT electron beam lithography system of Thomas et al. could be adapted

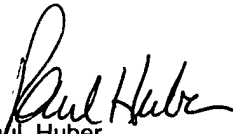
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for high information density storage, for the purpose of inscribing information at extremely high information density into a storage medium for data storage.

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication should be directed to Paul Huber at telephone number 703-308-1549.

  
Paul Huber  
Primary Examiner  
Art Unit 2653

pwh  
February 3, 2005